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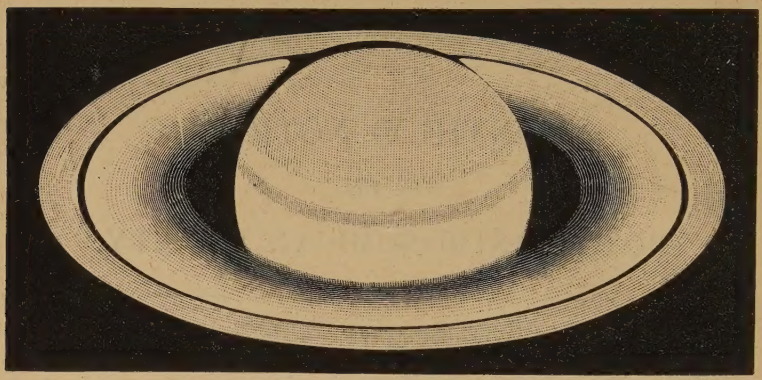
Note on a Narrow Belt seen on the Planet Saturn.

By A. C. Ranyard.

While observing the planet *Saturn* on the evening of November 4, 1883, at about 10 P.M., with an 18-inch silver-on-glass Reflector, I noticed a narrow dark belt on the body of the planet; it stretched across the disk, and at moments of good definition could be seen to fade away towards either limb; but I thought that the decrease in intensity was not as marked as in the case of similar belts upon *Jupiter*. The colour of the belt was a dark-blue gray, decidedly different from the reddish-brown of the belts upon *Jupiter*. On this evening it was a striking object, nearly as easily seen as the Cassini division in the ring, though not so dark. I estimated its breadth as about double the breadth of the Cassini division, where it is seen broadest in the ansæ. I did not very accurately estimate its position upon the planet; it was quite clear of the projection of the gauze ring upon the ball, and was possibly 10° or 15° to the south of the equatorial regions. On the evening of the 4th the belt was so easily seen that I showed it to two persons who were quite unused to looking through a telescope, and I have little doubt, from their answers to my questions, that they saw the belt I have described. At about eleven o'clock the sky became cloudy, and I had no further chance of examining the planet till the evening of November 13, at about a quarter past twelve, when I again saw the narrow belt stretching all across the ball. The definition was not as good as on the 4th, and the belt was much more difficult to make out than on the former occasion. I thought it was decidedly less dark. It was still narrow, but nebulous, and there was no comparison between its visibility and the visibility of the Cassini division. I continued observing it till half-past one, and

only saw it in the intervals of good definition. However, I had no doubt about its being there, and that it stretched all across the disk.



Saturn at End of 1883 and Beginning of 1884.

I did not again have an opportunity of examining the planet till the evening of the 21st, at about half-past nine, when the definition was fairly good. I distinctly saw the narrow belt; it still appeared to me to be bluish-gray, decidedly darker than the south polar cloud-cap, from which it was separated by an interval of more than its own breadth. It appeared to me to extend all across the disk, and I again noticed that I could trace it to the limb, with but little if any decrease in intensity. The central part of the belt appeared to me to be below (that is, to the north of) the major axis of the rings, while the extremities of the belt were about an equal distance above the major axis. I was struck by the fact that the inner edge of the gauze ring seen projected upon the body of the planet appeared to be more curved than the narrow belt on the body of the planet. On several other occasions I have noticed the great curvature of the edge of the gauze ring as seen projected on the body of the planet. The Rev. T. W. Webb writes me that he has noticed this appearance, and that to his eye it appeared more curved on the preceding than on the following side. A friend, to whom I pointed out the decided curvature of the inner edge of the gauze belt as compared with the curvature of the outer edge of the rings, suggested that the appearance must be due to the shadow of the rings projected on the ball of the planet; but the position of the sun as compared with the plane of the rings shows that the shadow of the rings at the time could not be seen from the earth. I would suggest that the appearance may probably be explained by the fact that the central part of the disk of the planet is brighter than the limb, and that the gauze belt is best seen where it is projected on the fainter background.

On the evening of November 21 Mr. B. J. Hopkins was with me, and spent some time in examining the planet. He stated that he distinctly saw the dark belt, but he did not agree with me that it could be traced all across the disk. He, however, concurred with me as to its breadth and its position with regard to the major axis of the rings.

Dr. Copeland writes to me, under date 1883 December 1, that he saw on November 6 "a dark belt on the body of *Saturn*, in about 20° south latitude, sharp towards the equator and shaded off towards the pole. Breadth about twice that of the great division in the ring."

Addendum.

Mr. Denning has sent me a highly-finished drawing of *Saturn*, made with a 12-inch Reflector, on January 7, 1884. It clearly shows the dark belt above described separated from the polar cloud-cap by a brighter division of about its own breadth. He has also sent a drawing of the planet made in November 1882, which shows a similar belt which is not separated by a bright division from the polar cloud-cap.

Mr. George Hunt has also sent me a drawing, showing the narrow belt as seen with his 8-inch Cooke Refractor on the evening of January 24. He describes it as a thickening of the line of demarcation between the bright equatorial belt and the polar cloud-cap. The thickness of the dark belt and its position with regard to the major axis of the rings agrees well with the drawing given above.

There were slight inequalities in the thickness of the narrow belt—it appeared to be more sharply defined on its northern than on its southern edge. I should describe it as nebulous, and certainly not broken up into a chain of cloud masses as shown in the drawing of Trouvelot and Pratt. I have not seen any other belts or streaks upon the ball of the planet, or any white patch at the southern pole.

Nor have I at any time seen any sharp line of demarcation between the gauze ring and the bright ring B, as shown in most drawings. The gauze ring appears to me to shade insensibly into the brighter ring. The inner bright ring (B) appears to have a brighter broad band adjacent to the Cassini division, but I do not feel sure that this may not be due to contrast with the dark space. I have not at any time seen any brighter stripe upon the outermost ring (A), as shown in Mr. De La Rue's celebrated drawing of the planet, and in many other subsequent drawings. Instead of a bright stripe towards the outer edge of ring (A), the light of the ring seems to me sensibly to degrade from near the centre of ring (A) to its outer edge.

Apparent Places of Comet II. (*Ross*), 1883. By John Tebbutt.

On February 12 last I forwarded the apparent places of a small comet discovered by Mr. Ross, of Elstemwick, Victoria, and observed here from January 19 to February 2. As already intimated, my differential comparisons of that comet were made by means of a square bar-micrometer. The instrument is similar to that described in the Introduction to Cooper's *Catalogue of Ecliptic Stars*, with the addition of spider lines to represent the diagonals of the square. Before commencing the series of comet observations the micrometer was so adjusted that a star at an altitude of 40° or upwards would be bisected by one of the spider lines at the moments of its entering and quitting the field of the telescope. This adjustment was not altered during the whole series of observations, and was repeatedly verified. It was found, however, by numerous comparisons of pairs of stars from Stone's Cape Catalogue, where difference of Declination was considerable, that this adjustment was not consistent with an exact orientation of the micrometer, and a constant was therefore deduced from these observations for the proper correction of the comet's Right Ascensions, the corrections in north-polar distance being hardly sensible. The following table exhibits the corrected places of the comet:—

Windsor Mean Time.					Comet's Apparent R.A.			N.P.D.		
1884.	d	h	m	s	h	m	s	°	′	″
Jan.	19	9	37	42	22	54	35·62	131	46	56·3
	19	9	37	42	22	54	35·53	131	46	56·5
	21	9	26	7	23	5	2·19	131	54	59·2
	21	9	31	39	23	5	3·72	131	55	2·7
	22	9	3	4	23	9	44·51	131	57	21·3
	22	9	3	4	23	9	44·66	131	57	19·5
	23	9	22	11	23	14	18·36	131	58	45·3
	23	9	22	11	23	14	18·47	131	58	43·8
	24	8	51	49	23	18	28·64	131	59	15·1
	24	8	51	49	23	18	28·71	131	59	12·6
	25	9	14	35	23	22	33·60	131	59	19·6
	25	9	14	35	23	22	33·79	131	59	18·7
	27	8	50	59	23	29	56·93	131	57	33·4
	27	8	50	59	23	29	57·04	131	57	31·6
	28	8	56	48	23	33	26·84	131	55	54·1
	28	8	56	48	23	33	26·65	131	55	50·9
Feb.	2	9	38	9	23	48	47·64	131	44	19·1

I trust these corrected places of the comet may be published before a definitive orbit is attempted.

Windsor, N. S. Wales:
1884 *May* 31.

Observations of the Comet of 1812 (*Pons-Brooks*) *at its return to Perihelion in* 1884. By John Tebbutt.

I herewith forward my complete observations of this interesting comet. They were made with a square bar-micrometer on the 4½-inch Equatorial. The comet ceased to be visible to the unassisted eye on February 22. From January 13 to February 9 it presented a stellar nucleus which admitted of precise observation, and from the latter date to March 2 there was an ill-defined condensation which could be observed with tolerable accuracy. After March 2 it was difficult to observe the comet, for it appeared as a round nebula with scarcely any condensation in its centre. On April 1 it was excessively faint in consequence of the increasing moonlight. After the withdrawal of the full moon the comet was found again on April 21, but it was of the last degree of faintness, and its position could therefore be only roughly determined as follows:—

April 21 h m s 7 27 14 Windsor M.T. App. R.A. = h m s 4 17 53·8.

App. N.P.D. ° ′ ″ 155 45 37.

In determining the places of the comparison stars proper motion has been applied where practicable. The parallax corrections are based on Schulhof and Bossert's Ephemerides in Nos. 2558, 2569, and 2570 of the *Astronomische Nachrichten*, with an assumed equatorial horizontal solar parallax of 8″·85.

Apparent Places of the Comet of 1812 (Pons-Brooks).

Windsor M. T.				App. R.A.			App. N.P.D.			Parallax Corrections. R.A. +	N.P.D. +	No. of Comps.	Comp. Star.
1884.	d	h	m	s	h	m	s	°	′	″	s	″		
Jan.	13	8	25	55	23	3	46·24	88	20	32·6	0·73	7·7	7	1
	19	8	19	13	23	37	33·25	99	14	9·2	0·68	6·4	5	2
	19	8	24	8	*	+5	21·84	*	−1	35·0	0·69	6·5	6	3
	21	8	30	14	23	47	37·43	102	35	24·3	0·68	6·0	6	4
	21	8	30	14	23	47	37·30	102	35	19·4	0·68	6·0	6	5
	22	8	6	50	23	52	18·26	104	9	53·4	0·65	5·6	5	6
	23	8	17	24	23	56	58·69	105	43	42·2	0·65	5·4	3	7
	23	8	17	24	23	56	58·78	105	43	44·9	0·65	5·4	3	8
	25	8	32	16	0	5	49·45	108	42	6·6	0·66	5·2	8	9
Feb.	2	8	22	40	*	−1	41·27	*	+15	42·7	0·61	3·5	5	10
	2	8	22	40	0	35	28·30	118	37	1·6	0·61	3·5		11
	2	8	22	40	0	35	28·39	118	36	58·8	0·61	3·5	5	12
	4	8	24	37	0	41	42·29	120	40	3·8	0·61	3·3	14	13

Windsor M. T.				App. R.A.			App. N.P.D.			Parallax Corrections. R.A. +	N.P.D. +	No. of Comps.	Comp. Star.
1884. d	h	m	s	h	m	s	°	′	″	s	″		
5	8	34	54	0	44	40·81	121	38	35·7	0·62	3·3	5	14
5	8	34	54	0	44	40·62	121	38	32·0	0·62	3·3	5	15
5	8	34	54	0	44	40·54	121	38	50·8	0·62	3·3	5	16
8	8	33	13	0	52	59·38	124	20	16·5	0·61	3·0	10	17
9	8	23	28	0	55	35·17	125	10	2·6	0·60	2·7	3	18
9	8	23	28	0	55	34·95	125	10	3·0	0·60	2·7	3	19
10	8	22	9	0	58	6·37	125	58	18·4	0·60	2·6	10	20
17	8	53	48	1	14	12·69	130	54	34·1	0·61	2·8	5	21
17	8	53	48	1	14	12·15	130	54	35·0	0·61	2·8	5	22
22	8	16	26	1	24	24·46	133	47	58·6	0·59	1·9	10	23
22	8	16	26	1	24	23·97	133	47	56·7	0·59	1·9	10	24
22	8	58	42	1	24	28·11	133	48	56·4	0·61	2·8	5	23
25	8	36	50	1	30	20·26	135	22	3·1	0·60	2·3	4	25
25	8	36	50	1	30	19·96	135	22	2·6	0·60	2·3	4	26
25	8	36	50	1	30	19·73	135	22	0·4	0·60	2·3	4	27
25	8	36	50	1	30	19·72	135	22	2·2	0·60	2·3	4	28
26	8	25	18	1	32	15·74	135	51	27·6	0·60	2·0	8	29
29	8	41	41	1	38	6·24	137	16	49·7	0·60	2·3	4	30
Mar. 2	8	4	26	1	41	56·04	138	9	50·0	0·59	1·6	3	31
2	8	4	26	*	−5	40·18	*	+4	33·6	0·59	1·6	3	32
7	8	42	43	1	51	53·84	140	17	9·5	0·61	2·3	1	33
8	7	37	4	1	53	49·86	140	39	52·4	0·58	1·0	1	33
8	7	37	4	1	53	49·69	140	39	50·9	0·58	1·0	1	34
9	8	2	39	1	55	55·38	141	4	0·6	0·60	1·6	4	35
9	8	2	39	1	55	55·61	141	4	3·9	0·60	1·6	4	36
9	8	2	39	1	55	55·26	141	3	59·9	0·60	1·6	4	37
9	8	59	13	1	56	0·71	141	4	55·3	0·61	2·7	7	37
14	8	7	51	*	−1	56·14	*	−3	10·8	0·62	1·7	6	38
14	8	7	51	2	6	35·94	142	58	52·8	0·62	1·7	6	39
21	8	3	59	2	23	0·92	145	30	57·0	0·64	1·6	3	40
21	8	18	13	2	23	3·82	145	31	5·3	0·64	1·9	7	41
24	8	2	21	2	30	48·05	146	34	18·6	0·65	1·6	2	42
24	8	2	21	2	30	46·99	146	34	17·0	0·65	1·6	2	43
24	8	2	21	2	30	47·20	146	34	15·3	0·65	1·6	2	44
April 1	8	25	25	2	54	14·21	149	20	10·9	0·68	2·0	8	45
1	8	25	25	2	54	13·94	149	20	9·7	0·68	2·0	8	46

Mean Places of the Comparison Stars for 1884·0, *and the Reductions to the Apparent Places for the Dates of Observation.* By John Tebbutt.

Star.	Mean R.A.	Reduction.	Mean N.P.D.	Reduction.	Authority for Mean Place.
	h m s	s	° ′ ″	″	
1	23 2 44·38	−0·10	88 30 12·4	− 3·6	Lamont 9097; Radcl. Obs. 1858, 1491; Wash. Cat. 1860, 10184; Greenw. 7 Yr. Cat. 1864, 2646; Bruxelles Obs. 1873, 3980 (Lamont N.P.D. rejected).
2	23 35 37·44	−0·11	99 27 53·4	+ 1·1	Schj. 9783.
3	23 32 12	−0·12	99 16	+ 0·9	Approx. Position per Equat. Star 6½ mag.
4	23 41 17·30	−0·14	102 33 8·5	+ 2·2	Schj. 9832, 9833; Greenw. 9 Yr. Cat. 1872. 2224; Bruxelles Obs. 1873, 4109; Cape Cat. 1880, 12286.
5	23 46 49·53	−0·11	102 39 37·2	+ 2·5	Schj. 9890.
6	23 56 16·50	−0·09	104 3 16·0	+ 3·3	Lalande 47123.
7	23 56 51·12	−0·12	105 41 7 0	+ 3·8	Arg. Oeltzen, 23201.
8	0 2 21·07	−0·09	105 28 11·3	+ 4·0	„ 6.
9	0 6 14·96	−0·14	108 34 55·0	+ 5·0	„ 47; Wash. Cat. 1860, 54.
10	0 37 10	−0·27	118 21	+ 8·8	Approx. Position per Equat. Star 8½ mag.
11	0 39 28·75	−0·26	118 24 11·9	+ 9·0	A. O. 395; Cord. Zone 95, 13 and 96, 18.
12	0 50 17·87	−0·20	118 24 15·5	+ 9·6	A. O. 516 and 517; Wash. Cat. 1860, 486; Cord. Zone 97, 11; Cape Cat. 1880, 365.
13	0 40 58·37	−0·33	120 49 30·4	− 9·4	A. O. 410; Wash. Merid. Tr. Zone 77, 100; Wash. Cat. 1860, 384; Cord. Zone 90, 43; Radcl. Obs. 1880, 18; Cape Cat. 1880, 307 (Arg. Oeltzen N.P.D. rejected).
14	0 40 18·28	−0·36	121 20 39·8	+ 9·4	Cordoba Zone 77, 80.
15	0 45 59·51	−0·34	121 36 58·7	+ 9·8	Wash. Merid. Tr. Zone 87, 46; Cord. Zone 77, 90.

Star	Mean R.A.	Reduction.	Mean N.P.D.	Reduction.	Authority for Mean Place.
	h m s	s	° ′ ″	″	
16	0 46 17·79	−0·33	121 35 39·5	+ 9·9	Wash. Merid. Tr. Zone 87, 47; Cord. Zone 77, 91 (N.P.D. unsatisfactory; the authorities differ by 28″·2).
17	0 59 4·24	−0·38	124 9 17·4	+10·9	Wash. Merid. Tr. Zone 100, 19; Wash. Cat. 1860, 555; Cord. Zone 49, 53; Cape Cat. 1880, 418 (Wash. M. Tr. Zone N.P.D. rejected).
18	0 53 55·34	−0·45	125 15 48·5	+10·7	Wash. Mural Cir. Zone 83, 16; Wash. Cat. 1860, 512; Cord. Zone 101, 5; Cape Cat. 1880, 384 (W. Mural Cir. Zone R.A. rejected).
19	1 0 50·90	−0·41	125 25 7·9	+11·2	Cord. Zone 101, 13; Cape Cat. 1880, 429.
20	1 1 0·15	−0·45	126 16 52·3	+11·2	Wash. Mural Cir. Zone 80, 2; Wash. Cat. 1860, 577; Wash Obs. 1873, 45; Cord. Zone 101, 12; Cape Cat. 1880, 431. The individual results for N.P.D. inconsistent.
21	1 0 1·50	−0·71	130 53 28·6	+10·9	Cord. Zone 85, 91; Cape Cat. 1880, 425.
22	1 13 10·45	−0·64	130 42 52·0	+11·9	,, 85, 107.
23	1 23 19·66	−0·80	133 54 45·8	+12·2	Melb. Cat. 1870, 97; Cord. Zone 104, 29; Cape Cat. 1880, 580
24	1 24 24·60	−0·79	133 45 13·2	+12·3	Cord. Zone 104, 31.
25	1 19 39·60	−0·92	135 7 57·6	+11·5	,, 38, 67 and 104, 27; Cape Cat. 1880, 554.
26	1 27 47·08	−0·89	135 20 6·6	+12·2	,, 38, 79.
27	1 31 47·16	−0·88	135 23 51·6	+12·6	,, 38, 83.
28	1 33 48·87	−0·85	135 11 8·9	+12·7	,, 38, 85; Cape Cat. 1880, 653.
29	1 26 43·20	−0·95	136 10 24 1	+12·0	Melb. Obs. 1874, 32; Cord Zone 38, 77; Cape Cat. 1880, 606.
30	1 24 35·83	−1·07	137 21 25·1	+11·3	Cape Cat. 1880, 587.
31	1 45 40·63	−1·07	138 23 36·5	+12·8	Cord. Zone 16, 63; Cape Cat. 1880, 732.

Star.	Mean R.A.	Reduction.	Mean N.P.D.	Reduction.	Authority for Mean Place.
	h m s	s	° ′ ″	″	
32	1 47 37	−1·04	138 5	+13·0	Approx. Position per Equat. Star 8½ mag.
33	1 51 41·22	−1·24	140 24 16·3	+12·4	Cord. Zone 9, 56 and 83, 156; Cape Cat. 1880, 769.
33	1 51 41·22	−1·26	140 24 16·3	+12·1	,, ,, ,,
34	1 57 31·84	−1·25	140 41 17·3	+12·7	Cord. Zone 9, 60; 83, 164 and 116, 4.
35	1 44 20·26	−1·36	141 3 39·6	+11·3	,, 83, 144; Cape Cat. 1880, 722.
36	1 46 24·34	−1·33	140 46 50·6	+11·4	,, 83, 148; Melb. Obs. 1875,35; Cape Cat. 1880,738.
37	1 57 54·02	−1·29	141 3 7·8	+12·5	,, 83, 165.
38	2 8 34	−1·47	143 2	+12·4	Approx. Position per Equat. Star 9 mag.
39	2 11 37·33	−1·44	142 44 53·1	+12·7	Cord. Zone 119, 17; Cape Cat. 1880, 907.
40	2 35 20·56	−1·66	145 20 12·4	+13·3	Cord. Zone 128, 13; Cape Cat. 1880, 1079. (The N.P. distances of Nos. 1078 and 1079 of the Cape Cat. 1880 have obviously been interchanged. The N.P.D. of 1078 adopted.)
41	2 15 50·80	−1·78	145 32 56·1	+11·3	Cord. Zone 98, 116.
42	2 16 8·74	−1·92	146 28 39 1	+10·5	,, 98, 119; Cape Cat. 1880, 936.
43	2 37 54·57	−1·81	146 28 21·9	+12 8	,, 128, 16.
44	2 38 10·02	−1·84	146 47 29·5	+12·8	,, 128, 18; Cape Cat. 1880, 1108.
45	2 54 40·06	−2·20	149 22 9·2	+12·3	,, 91, 13.
46	3 0 36·73	−2·17	149 23 6·2	+12·9	,, 91, 22; Cape Cat. 1880, 1271.

Windsor, N. S. Wales:
1884 *July* 15.

Ephemeris for Physical Observations

Greenwich Noon.		Angle of Position of ♃'s Axis.	Latitude of Earth above ♃'s Equator.	Latitude of Sun above ♃'s Equator.	Δ−L.	L−O.	Longitude of ♃'s Central Meridian.	Diff.	Corr. for Phase.
1884.		°	°	°	°	°	°	+	°
Oct.	20	22·860	−0·587	−0·327	− 8·979	15 125	92·73	4391·26	+0·35
	25	23·008	·632	·348	9·368	15·905	163·99	1·33	·38
	30	23·143	·676	·369	9·710	16·638	235·32	1·39	·41
Nov.	4	23·266	−0 719	−0·390	−10·001	17·321	306·71	1·45	+0·44
	9	23·376	·761	·411	10·239	17·949	18·16	1·52	·46
	14	23·474	·801	·431	10·420	18·519	89·68	1·58	·47
	19	23·559	·840	·452	10·538	19·028	161·26	1·65	·48
	24	23·632	·877	·473	10·590	19·471	232·91	1·73	·49
	29	23·692	·912	·493	10·573	19·844	304·64	1·80	·49
Dec.	4	23·741	−0·945	−0·514	−10·484	20·145	16·44	1·87	+0·48
	9	23·777	0·975	·534	10·320	20·370	88·31	1·94	·46
	14	23·801	1·002	·555	10·078	20·518	160·25	2·01	·44
	19	23·813	1·027	·575	9·758	20·586	232·26	2·08	·41
	24	23 813	1·049	·596	9·355	20·572	304·34	2·14	·38
	29	23·801	1·068	·616	8·871	20·477	16·48	2·20	·34
1885.									
Jan.	3	23 776	−1·084	−0·637	−8 307	20·302	88 68	4392·26	+0·30
	8	23·738	1·096	·657	7 666	20·049	160·94	2·31	·26
	13	23·688	1·104	·677	6·949	19·720	233·25	2·35	·21
	18	23·626	1·109	·698	6·161	19·319	305·60	2·38	·17
	23	23·552	1·110	·718	5·308	18·853	17·98	2·41	·12
	28	23·466	1·107	·738	4·398	18·332	90·39	2·42	·08
Feb.	2	23·371	−1·101	−0·758	−3·440	17·763	162 81	2·42	+0·05
	7	23·267	1·091	·778	2·444	17·153	235·23	2·41	·03
	12	23·155	1·078	·798	1·419	16·515	307 64	2·39	+ ·01
	17	23·036	1 063	·818	−0·378	15 861	20·03	2·35	·00
	22	22·914	1·045	·838	+0·666	15·202	92·38	2·30	·00
	27	22·790	1·025	·858	1·703	14·552	164·68	2·24	−·01
Mar.	4	22·667	−1·003	−0 878	+2·720	13·922	236·92	4392·18	−0·03
	9	22·547	0·981	·898	3·706	13·322	309·10	2·10	·06
	14	22·433	·958	·918	4·651	12·762	21·20	2·02	·09
	19	22·326	·935	·938	5·547	12·252	93·22	1·92	·13
	24	22·230	·912	·957	6·384	11·801	165·14	1·83	·18
	29	22·147	·890	·977	7·156	11·415	236·97	1·74	·22

of Jupiter, 1884–85. By A. Marth.

Greenwich Noon.	Diameter Equat.	Diameter Polar.	Difference of limbs in A. R.	Difference of limbs in Decl.	Defect of illumination. Equat. preced. limb	Defect of illumination. in A. R.	Defect of illumination. in Decl. north *l.*	*d*	*w*
1884.	″	″	s	″	″	s	″	°	°
Oct. 20	33·57	31·43	2·267	31·76	0·21	0·012	0·03	8·98	268·27
25	33·97	31·80	2·292	32·14	·23	·013	·03	9·37	268·19
30	34·39	32·20	2·319	32·54	·25	·015	·03	9·72	268·12
Nov. 4	34·83	32·62	2·347	32·97	0·26	0·016	0·04	10·01	268 04
9	35·31	33·06	2·376	33·42	·28	·017	·04	10·25	267·97
14	35·80	33·52	2·407	33 89	·30	·018	·04	10·43	267·90
19	36·32	34·01	2·441	34·39	·31	·018	·04	10·55	267·82
24	36·86	34·52	2·476	34·90	·31	·019	·04	10·60	267·74
29	37·42	35·04	2·512	35·43	·32	·019	·04	10·58	267·65
Dec. 4	37·99	35·57	2·550	35·98	0·32	0·019	0·04	10·49	267·56
9	38·58	36·12	2·588	36·53	·31	·019	·04	10·33	267·47
14	39·17	36·67	2·627	37·09	·30	·018	·04	10·09	267·36
19	39·76	37·23	2·667	37·65	·29	·017	·04	9·77	267·25
24	40·35	37·78	2·707	38·21	·27	·016	·04	9·37	267·11
29	40·93	38·32	2 746	38·76	·24	·015	·03	8·88	266·96
1885.									
Jan. 3	41·49	38·85	2·785	39·29	0·22	0·013	0·03	8·32	266·79
8	42·03	39·35	2·822	39·80	·19	·011	·02	7·68	266·57
13	42·53	39·82	2·857	40·27	·16	·009	·02	6·96	266·26
18	42·99	40·25	2·890	40·71	·12	·008	·02	6·17	265·89
23	43·40	40·64	2·920	41·10	·09	·006	·01	5·32	265·44
28	43·76	40·97	2·946	41·43	·06	·004	·01	4·42	264·92
Feb. 2	44·05	41·24	2·968	41·70	0·04	0·002	·00	3·46	264·0
7	44·27	41·45	2·986	41·90	·02	·001		2 47	262·2
12	44·42	41·59	2·999	42·04	·00	·000		1·45	258·5
17	44·48	41·65	3 006	42·10	following limb.		south	0·46	235·3
22	44·47	41·64	3·008	42·08	·00	·000	*l.*	0·70	108·4
27	44·38	41·55	3·005	41·99	·01	·001		1·71	96·0
Mar. 4	44·21	41·40	2·997	41·83	0 03	0·002	0 00	2·72	92·8
9	43·97	41·17	2·983	41·59	·05	·003	·01	3·71	91·34
14	43·66	40·88	2·965	41·29	·07	·004	·01	4·65	90·49
19	43·29	40·53	2·942	40·94	·10	·006	·02	5·55	89 91
24	42·87	40·14	2·915	40·54	·13	·008	·02	6·38	89·50
29	42·40	39·70	2·885	40·09	·17	·010	·02	7·16	89·20

Greenwich Noon.		Angle of Position of ♃'s Axis.	Latitude of Earth above ♃'s Equator.	Latitude of Sun above ♃'s Equator.	Λ−L.	L−O.	Longitude of ♃'s Central Meridian.	Diff.	Corr. for Phase.
1884.		°	°	°	°	°	°		°
Apr.	3	22·077	−0·870	−0·977	+7·858	11·098	308·71	4391·63	−0·27
	8	22·023	·851	1·016	8·488	10·853	20·34	1·54	·31
	13	21·985	·834	1·036	9·042	10·684	91·88	1·44	·35
	18	21·964	·819	1·055	9·518	10·593	163·32	1·35	·39
	23	21 960	·806	1·074	9·916	10·580	234·67	1·26	·43
	28	21·973	·796	1·094	10·236	10·644	305·93	1·18	·46
May	3	22·003	−0·789	−1·113	+10·481	10·784	17·11	4391·09	−0·48
	8	22·048	·785	1·132	10 652	10·997	88·20	1·01	·49
	13	22·109	·783	1·151	10·751	11 282	159·21	0·95	·50
	18	22·184	·784	1·170	10·782	11·635	230·16	0·88	·51
	23	22·272	·788	1·189	10·747	12·054	301·04	0·82	·50
	28	22·372	·794	1·208	10·649	12·536	11·86	0·77	·49
June	2	22·482	−0·803	−1·227	+10·492	13·076	82·63	0·72	−0·48
	7	22·602	·815	1·246	10·279	13·672	153·35	0·67	·46
	12	22·729	·829	1·264	10·013	14·321	224·03	0·63	·44
	17	22·863	·846	1·283	9·699	15·019	294·66	0·60	·41
	22	23·002	·865	1·302	9·339	15·762	5·26	0·58	·38
	27	23·145	·886	1·320	8·936	16·547	75·84	0·55	·35
July	2	23·291	−0·910	−1·339	+ 8·494	17·371	146·39	4390·53	−0·31
	7	23·438	0·936	1·357	8·017	18·231	216 92		·28

The angle Λ−L is the difference of the Jovicentric longitudes of the Sun and the Earth, reckoned in the plane of *Jupiter's* equator, L−O+180° the Jovicentric longitude of the Earth reckoned from O, the point of *Jupiter's* vernal equinox or the point of the descending node of the planet's equator on the orbit.

The assumed daily rate of rotation, on which the "Longitude of ♃'s Central Meridian" depends, is 878°·34, the corresponding period being $9^h\ 50^m\ 20^s{\cdot}25$. This rate represents approximately the motion of the white equatorial spot during the interval from the autumn of 1882 to the spring of 1884. As the great reddish spot has so faded away that its place can only be recognised with difficulty, and the white equatorial spot seems likely to remain a fairly defined feature of *Jupiter's* surface for some time to come, I have thought it better to make the change, and to assume the new First or Zero Meridian near the white spot, so that the predicted times of the passages of the First Meridian across the middle of the disk may serve also for those of the white spot, supposing that the motion of the latter has not

Greenwich Noon.		Diameter Equat.	Diameter Polar.	Difference of limbs in A. R.	Difference of limbs in Decl.	Defect of illumination. Equat. preced. limb	Defect of illumination. in A. R. limb	Defect of illumination. in Decl. north *l.*	*d*	*w*
1884.		"	"	s	"	"	s	"	°	°
Apr.	3	41·89	39·22	2·852	39·61	0·20	0·012	0·03	7·86	88·95
	8	41·35	38·71	2·816	39·10	·23	·014	·03	8·49	88·74
	13	40·79	38·19	2·778	38·57	·25	·015	·03	9·04	88·56
	18	40·21	37·65	2·739	38·02	·28	·017	·04	9·52	88·41
	23	39·62	37·10	2·699	37·46	·30	·018	·04	9·92	88·26
	28	39·03	36·55	2·659	36·90	·31	·019	·04	10·24	88·13
May	3	38·45	36·00	2·618	36·35	0·32	0·020	0·04	10·49	88·02
	8	37·87	35·45	2·577	35·80	·33	·020	·04	10·66	87·91
	13	37·30	34·92	2·537	35·27	·33	·020	·04	10·76	87·81
	18	36·74	34·40	2·498	34·75	·32	·020	·04	10·79	87·72
	23	36·20	33·90	2·460	34·24	·32	·019	·04	10·76	87·62
	28	35·68	33·41	2·423	33·75	·31	·019	·04	10·66	87·53
June	2	35·19	32·95	2·387	33·28	0·29	0·018	0·04	10·50	87·44
	7	34·71	32·50	2·352	32·84	·28	·017	·03	10·29	87·35
	12	34·26	32·08	2·319	32·41	·26	·016	·03	10·02	87·25
	17	33·83	31·68	2·288	32·01	·24	·015	·03	9·71	87·16
	22	33·43	31·30	2·258	31·63	·22	·014	·03	9·35	87·05
	27	33·05	30·95	2·230	31·28	·20	·012	·03	8·95	86·95
July	2	32·70	30·62	2·203	30·95	0·18	0·011	0·02	8·51	86·84
	7	32·37	30·31	2·178	30·65	·16	·009	·02	8·03	86·73

changed meanwhile too considerably. In the Supplementary Number of vol. xlii. I have given a list of the observed passages of the white spot, which had become known to me up to August 1882, together with the corresponding longitudes of the spot in a system, in which the adopted daily rate of rotation is 878°·46. In order to reduce these longitudes to the system adopted in the present ephemeris, it will be sufficient to apply the corrections derived by interpolation from the following values:—

	Corr.		Corr.		Corr.
	°		°		°
1880, Sept.	6·0 + 65·0	1881, July	3·0 + 29·0	1882, Jan.	19·0 + 5·0
Oct. 1	62	28	26	Feb. 13	+ 2·0
26	59	Aug. 22	23	Mar. 10	− 1·0
Nov. 20	56	Sept. 16	20	Apr. 4	− 4·0
Dec. 15	53	Oct. 11	17		
1881, Jan. 9	50	Nov. 5	14	July 13	−16·0
Feb. 3	47	30	11	Aug. 7·0	−19·0
	28·0 + 44·0	Dec. 25·0	+ 8·0		

It would be premature to enter upon the discussion of the changes of the spot's motion till all the observations of it have become available.

If the "Correction for Phase" is added to the longitude of ♃'s Central Meridian or of the meridian directed to the Earth, the longitude of the meridian is found which bisects the illuminated disk of the planet.

The assumed value of *Jupiter's* equatorial diameter is 37″·60 at the distance 5·20273. The assumed proportion of the polar axis to the equatorial diameter is 0·9363. The defect of illumination of the apparent polar diameter is insensible. The last columns give the values of the auxiliary angles d and w required in the computations for defect of illumination, as explained in vol. xl., p. 490ff.

The following is a list of the Greenwich mean times, when the assumed First Meridian of *Jupiter* passes the middle of the illuminated disk:—

1884.	h	m	1884.	h	m	1884.	h	m	1884.	h	m
Oct. 20	17	7·9	Oct. 30	13	14·0	Nov. 9	9	19·7	Nov. 19	5	25·0
21	2	58·2		23	4·2		19	9·9		15	15·3
	12	48·4	31	8	54·5	10	5	0·2	20	1	5·5
	22	38·7		18	44·7		14	50·4		10	55·7
22	8	29·0	Nov. 1	4	35·0	11	0	40·5		20	45·9
	18	19·2		14	25·2		10	30·8	21	6	36·1
23	4	9·5	2	0	15·4		20	21·1		16	26·3
	13	59·7		10	5·7	12	6	11·3	22	2	16·5
	23	50·0		19	55·9		16	1·5		12	6·7
24	9	40·2	3	5	46·2	13	1	51·7		21	56·9
	19	30·5		15	36·4		11	42·0	23	7	47·1
25	5	20·8	4	1	26·6		21	32·2		17	37·3
	15	11·0		11	16·9	14	7	22·4	24	3	27·6
26	1	1·3		21	7·1		17	12·6		13	17·8
	10	51·5	5	6	57·4	15	3	2·9		23	8·0
	20	41·8		16	47·6		12	53·1	25	8	58·2
27	6	32·0	6	2	37·8		22	43·3		18	48·4
	16	22·3		12	28·1	16	8	33·5	26	4	38·6
28	2	12·5		22	18·3		18	23·7		14	28·8
	12	2·8	7	8	8·5	17	4	14·0	27	0	19·0
	21	53·0		17	58·8		14	4·2		10	9·2
29	7	43·3	8	3	49·0		23	54·4		19	59·4
	17	33·5		13	39·2	18	9	44·6	28	5	49·6
30	3	23·7		23	29·5		19	34·8		15	39·8

1884.	h	m	1884.	h	m	1884.	h	m	1885.	h	m
Nov. 29	1	30·0	Dec. 15	10	57·2	Dec. 31	20	23·4	Jan. 16	19	58·5
	11	20·1		20	47·4	1885.			17	5	48·6
	21	10·3	16	6	37·6	Jan. 1	6	13·6		15	38·8
30	7	0·5		16	27·8		16	3·7	18	1	28·9
	16	50·7	17	2	17·9	2	1	53·9		11	19·0
Dec. 1	2	40·9		12	8·1		11	44·0		21	9·1
	12	31·1		21	58·2		21	34·1	19	6	59·3
	22	21·3	18	7	48·4	3	7	24·3		16	49·4
2	8	11·5		17	38·6		17	14·4	20	2	39·5
	18	1·7	19	3	28·7	4	3	4·5		12	29·6
3	3	51·9		13	18·9		12	54·7		22	19·7
	13	42·1		23	9·1		22	44·8	21	8	9·9
	23	32·3	20	8	59·2	5	8	35·0		18	0·0
4	9	22·4		18	49·4		18	25·1	22	3	50·1
	19	12·6	21	4	39·5	6	4	15·2		13	40·2
5	5	2·8		14	29·7		14	5·4		23	30·3
	14	53·0	22	0	19·8		23	55·5	23	9	20·4
6	0	43·2		10	10·0	7	9	45·6		19	10·6
	10	33·4		20	0·2		19	35·8	24	5	0·7
	20	23·6	23	5	50·3	8	5	25·9		14	50·8
7	6	13·7		15	40·5		15	16·0	25	0	40·9
	16	3·9	24	1	30·6	9	1	6·1		10	31·0
8	1	54·1		11	20·8		10	56·3		20	21·1
	11	44·3		21	10·9		20	46·4	26	6	11·3
	21	34·5	25	7	1·1	10	6	36·5		16	1·4
9		24·6		16	51·2		16	26·7	27	1	51·5
	17	14·8	26	2	41·4	11	2	16·8		11	41·6
10	3	5·0		12	31·5		12	6·9		21	31·7
	12	55·2		22	21·8		21	57·0	28	7	21·8
	22	45·4	27	8	11·8	12	7	47·2		17	11·9
11	8	35·5		18	2·0		17	37·3	29	3	2·0
	18	25·7	28	3	52·1	13	3	27·4		12	52·1
12	4	15·9		13	42·3		13	17·5		22	42·3
	14	6·1		23	32·4		23	7·7	30	8	32·4
	23	56·2	29	9	22·6	14	8	57·8		18	22·5
13	9	46·4		19	12·7		18	47·9	31	4	12·6
	19	36·6	30	5	2·9	15	4	38·0		14	2·7
14	5	26·7		14	53·0		14	28·2		23	52·8
	15	16·9	31	0	43·1	16	0	18·3	Feb. 1	9	42·9
15	1	7·1		10	33·3		10	8·4		19	33·0

1885.	h	m	1885.	h	m	1885.	h	m	1885.	h	m
Feb. 2	5	23·2	Feb. 18	14	47·6	Mar. 7	0	12·8	Mar. 23	9	39·4
	15	13·3		19	0	37·7		10	2·9		19	29·6
3	1	3·4			10	27·9		19	53·1	24	5	19·7
	10	53·5			20	18·0	8	5	43·2		15	9·9
	20	43·6	20		6	8·1		15	33·4	25	1	0·1
4	6	33·7			15	58·2	9	1	23·5		10	50·3
	16	23·8	21	1		48·3		11	13·7		20	40·5
5	2	13·9			11	38·4		21	3·8	26	6	30·7
	12	4·0			21	28·6	10	6	54·0		16	20·9
	21	54·1	22	7		18·7		16	44·1	27	2	11·1
6	7	44·2			17	8·8	11	2	34·3		12	1·3
	17	34·4	23	2		58·9		12	24·4		21	51·5
7	3	24·5			12	49·0		22	14·6	28	7	41·7
	13	14·6			22	39·2	12	8	4·8		17	31·9
	23	4·7	24	8		29·3		17	54·9	29	3	22·1
8	8	54·8			18	19·4	13	3	45·1		13	12·3
	18	44·9	25	4		9·5		13	35·2		23	2·5
9	4	35·0			13	59·7		23	25·4	30	8	52·7
	14	25·1			23	49·8	14	9	15·5		18	42·9
10	0	15·2	26	9		39·9		19	5·7	31	4	33·1
	10	5·4			19	30·1	15	4	55·9		14	23·3
	19	55·5	27	5		20·2		14	46·0	Apr. 1	0	13·5
11	5	45·6			15	10·3	16	0	36·2		10	3·7
	15	35·7	28	1		0·5		10	26·4		19	53·9
12	1	25·8			10	50·6		20	16·5	2	5	44·1
	11	15·9			20	40·7	17	6	6·7		15	34·3
	21	6·0	Mar. 1	6		30·9		15	56·9	3	1	24·5
13	6	56·1			16	21·0	18	1	47·0		11	14·7
	16	46·3	2	2		11·1		11	37·2		21	5·0
14	2	36·4			12	1·3		21	27·4	4	6	55·2
	12	26·5			21	51·4	19	7	17·6		16	45·4
	22	16·6	3	7		41·5		17	7·7	5	2	35·6
15	8	6·7			17	31·7	20	2	57·9		12	25·8
	17	56·8	4	3		21·8		12	48·1		22	16·0
16	3	46·9			13	11·9		22	38·3	6	8	6·3
	13	37·0			23	2·1	21	8	28·4		17	56·5
	23	27·2	5	8		52·2		18	18·6	7	3	46·7
17	9	17·3			18	42·4	22	4	8·8		13	36·9
	19	7·4	6	4		32·5		13	59·0		23	27·2
18	4	57·5			14	22·7		23	49·2	8	9	17·4

1885.	h	m
Apr. 8	19	7·6
9	4	57·8
	14	48·1
10	0	38·3
	10	28·5
	20	18·8
11	6	9·0
	15	59·2
12	1	49·5
	11	39·7
	21	29·9
13	7	20·2
	17	10·4
14	3	0·6
	12	50·9
	22	41·1
15	8	31·4
	18	21·6
16	4	11·9
	14	2·1
	23	52·4
17	9	42·6
	19	32·9
18	5	23·1
	15	13·4
19	1	3·6
	10	53·9
	20	44·0
20	6	34·3
	16	24·6
21	2	14·9
	12	5·2
	21	55·4
22	7	45·7
	17	35·9
23	3	26·2
	13	16·5
	23	6·7
24	8	57·0
	18	47·2

1885.	h	m
Apr. 25	4	37·5
	14	27·8
26	0	18·1
	10	8·3
	19	58·6
27	5	48·9
	15	39·1
28	1	29·4
	11	19·7
	21	10·0
29	7	0·2
	16	50·5
30	2	40·8
	12	31·1
	22	21·3
May 1	8	11·6
	18	1·9
2	3	52·2
	13	42·4
	23	32·7
3	9	23·0
	19	13·3
4	5	3·6
	14	53·9
5	0	44·2
	10	34·4
	20	24·7
6	6	15·0
	16	5·3
7	1	55·6
	11	45·9
	21	36·2
8	7	26·5
	17	16·8
9	3	7·1
	12	57·4
	22	47·7
10	8	38·0
	18	28·2
11	4	18·5

1885.	h	m
May 11	14	8·8
	23	59·1
12	9	49·4
	19	39·8
13	5	30·1
	15	20·4
14	1	10·7
	11	1·0
	20	51·3
15	6	41·6
	16	31·9
16	2	22·2
	12	12·5
	22	2·8
17	7	53·1
	17	43·4
18	3	33·7
	13	24·0
	23	14·4
19	9	4·7
	18	55·0
20	4	45·3
	14	35·6
21	0	25·9
	10	16·2
	20	6·5
22	5	56·9
	15	47·2
23	1	37·5
	11	27·8
	21	18·1
24	7	8·5
	16	58·8
25	2	49·1
	12	39·4
	22	29·7
26	8	20·1
	18	10·4
27	4	0·7
	13	51·0

1885.	h	m
May 27	23	41·4
28	9	31·7
	19	22·0
29	5	12·3
	15	2·7
30	0	53·0
	10	43·3
	20	33·6
31	6	24·0
	16	14·3
June 1	2	4·6
	11	55·0
	21	45·3
2	7	35·6
	17	25·9
3	3	16·3
	13	6·6
	22	56·9
4	8	47·3
	18	37·6
5	4	27·9
	14	18·3
6	0	8·6
	9	58·9
	19	49·3
7	5	39·6
	15	30·0
8	1	20·3
	11	10·6
	21	1·0
9	6	51·3
	16	41·6
10	2	32·0
	12	22·3
	22	12·7
11	8	3·0
	17	53·3
12	3	43·7
	13	34·0
	23	24·4

1885.	h	m	1885.	h	m	1885.	h	m	1885.	h	m
June 13	9	14·7	June 19	12	49·9	June 25	6	34·8	July 1	0	19·7
19	5·1		22	40·2		16	25·1		10	10·1	
14	4	55·4	20	8	30·6	26	2	15·5	20	0·4	
14	45·7		18	20·9		12	5·8	2	5	50·8	
15	0	36·1	21	4	11·3	21	56·2	15	41·2		
10	26·4		14	1·6	27	7	46·6	3	1	31·5	
20	16·8		23	52·0	17	36·9	11	21·9			
16	6	7·1	22	9	42·3	28	3	27·3	21	12·2	
15	57·5		19	32·7	13	17·6	4	7	2·6		
17	1	47·8	23	5	23·0	23	8·0	16	52·9		
11	38·2		15	13·4	29	8	58·3	5	2	43·3	
21	28·5		24	1	3·7	18	48·7	12	33·7		
18	7	18·9	10	54·1	30	4	39·0	22	24·0		
17	9·2		20	44·4	14	29·4	6	8	14·4		
19	2	59·6									

In case the remnant of the great reddish spot retains approximately the rate of motion at which it shifted during the interval from the autumn of 1882 to the spring of 1884, its place may be looked for near the Central Meridian at the times which precede or follow the predicted passages of the First Meridian by the interval indicated in the following table:—

1884,	Nov. 14	1885,	Feb. 12	Mar. 29	May 13	4 h.	before	F.M.
	19	Jan. 3	17	Apr. 3	18	3	,,	,,
	23	7	21	7	22	2	,,	,,
	28	12	26	12	27	1	,,	,,
Oct. 19	Dec. 3	17	Mar. 3	16	31	0	,,	,,
23	7	21	7	21	June 5	1	after	,,
28	12	26	12	26	9	2	,,	,,
Nov. 1	16	30	16	30	14	3	,,	,,
6	21	Feb. 4	21	May 5	19	4	,,	,,
11	25	8	25	9	23	5	,,	,,
15	30	13	29	14	28	6	,,	,,

Ephemerides of the Satellites of Saturn, 1884–85. By A. Marth.

(Continued from page 438.)

Differences of Right Ascension and Declination between the Satellites Titan, Hyperion, and Iapetus, and the Centre of Saturn.

	Titan.		*Hyperion.*		*Iapetus.*	
0^h Gr. 1884.	α_6-A	δ_6-D	α_7-A	δ_7-D	α_8-A	δ_8-D
	s	″	s	″	s	″
Nov. 1	+14·22	− 7·3	+ 3·05	−107·7	+35·33	+ 16·7
2	+14·42	+ 27·7	+ 7·87	− 96·9	37·14	31·6
3	+12·40	+ 58·4	+12·15	− 79·0	+38·72	+ 46·4
4	+ 8·40	+ 79·9	+15·61	− 56·1	40·08	61·0
5	− 3·02	+ 88·4	+18·12	− 29·1	+41·21	+ 75·2
6	− 2·87	+ 82·2	+19·48	− 0·4	42·10	89·1
7	− 8·29	+ 62·1	+19·63	+ 28·4	+42·74	+102·5
8	−12·35	+ 31·6	+18·51	+ 55·4	43·12	115·4
9	−14·41	− 4·2	+16·15	+ 78·7	+43·25	+127·6
10	−14·17	− 39·4	+12·62	+ 96·5	43·12	139·1
11	−11·75	− 68·7	+ 8·09	+106·7	+42·74	+149·8
12	− 7·58	− 87·8	+ 2·87	+107·7	42·10	159·7
13	− 2·29	− 94·3	− 2·63	+ 98·4	+41·20	+168·7
14	+ 3·33	− 87·3	− 7·85	+ 78·7	40·05	176·6
15	+ 8·48	− 68·0	−12·16	+ 49·7	+38·66	+183·6
16	+12·46	− 38·8	−14·97	+ 14·6	37·04	189·5
17	+14·61	− 4·1	−15·88	− 22·4	+35·19	+194·2
18	+14·58	+ 31·4	−14·82	− 56·8	33·12	197·8
19	+12·29	+ 62·0	−12·01	− 84·7	+30·85	+200·2
20	+ 8·05	+ 82·8	− 7·91	−103·5	28·37	201·4
21	+ 2·48	+ 90·1	− 3·03	−112·5	+25·72	+201·3
22	− 3·50	+ 82·2	+ 2·13	−111·6	22·91	200·0
23	− 8·92	+ 60·6	+ 7·14	−102·0	+19·95	+197·4
24	−12·85	+ 28·7	+11·65	− 85·0	16·85	193·6
25	−14·69	− 7·9	+15·37	− 62·3	+13·65	+188·5
26	−14·19	− 43·3	+18·13	− 35·4	10·35	182·2
27	−11·51	− 72·2	+19·72	− 6·3	+ 6·99	+174·7
28	− 7·12	− 90·3	+20·07	+ 23·2	3·57	166·1
29	− 1·68	− 95·4	+19·16	+ 51·3	+ 0·13	+156·4
30	+ 4·01	− 87·0	+16·96	+ 76·0	− 3·32	+145·6
Dec. 1	+ 9·13	− 66·2	+13·55	+ 95·3	− 6·75	+133·8
2	+12·95	− 35·7	+ 9·11	+107·3	10·13	121·1
3	+14·87	− 0·3	+ 3·90	+110·2	−13·45	+107·6

		Titan.		*Hyperion.*		*Iapetus.*	
	0h Gr.	α_8-A	δ_8-D	α_7-A	δ_7-D	α_9-A	δ_9-D
	1884.	s	"	s	"	s	"
Dec.	4	+14·57	+ 35·3	− 1·67	+102·8	16·68	93·3
	5	+12·02	+ 65·4	− 7·06	+ 84·6	−19·79	+ 78·3
	6	+ 7·54	+ 85·1	−11·63	+ 56·8	22·77	62·8
	7	+ 1·83	+ 90·7	−14·77	+ 22·0	−25·60	+ 46·8
	8	− 4·19	+ 81·3	−16·04	− 15·5	28·25	30·4
	9	− 9·51	+ 58·1	−15·29	− 51·2	−30·71	+ 13·8
	10	−13·19	+ 25·3	−12·73	− 80·8	32·95	− 2·9
	11	−14·82	− 11·8	− 8·76	−101·7	−34·95	− 19·7
	12	−14·04	− 47·0	− 3·92	−112·5	36·70	36·3
	13	−11·11	− 75·0	+ 1·28	−113·4	−38·20	− 52·7
	14	− 6·53	− 91·9	+ 6·38	−105·2	39·43	68·8
	15	− 0·98	− 95·5	+11·02	− 89·2	−40·37	− 84·4
	16	+ 4·67	− 85·6	+14·90	− 67·1	41·03	99·4
	17	+ 9·68	− 63·4	+17·82	− 40·7	−41·40	−113·7
	18	+13·30	− 32·2	+19·60	− 11·7	41·46	127·2
	19	+14·97	+ 3·6	+20·16	+ 18·1	−41·22	−139·8
	20	+14·39	+ 38·9	+19·43	+ 46·7	40·69	151·5
	21	+11·59	+ 68·1	+17·42	+ 72·1	−39·87	−162·1
	22	+ 6·93	+ 86·3	+14·20	+ 92·5	38·77	171·5
	23	+ 1·15	+ 90·4	+ 9·91	+105·9	−37·39	−179·7
	24	− 4·83	+ 79·3	+ 4·82	+110·5	35·74	186·7
	25	− 9·98	+ 55·0	− 0·71	+105·0	−33·85	−192·3
	26	−13·47	+ 21·4	− 6·14	+ 88·8	31·73	196·6
	27	−14·76	− 15·6	−10·87	+ 62·6	−29·38	−199·6
	28	−13·72	− 50·0	−14·26	+ 29·1	26·83	201·1
	29	−10·58	− 77·0	−15·86	− 8·3	−24·10	−201·2
	30	− 5·87	− 92·4	−15·44	− 44·5	21·21	200·0
	31	− 0·32	− 94·5	−13·18	− 75·3	−18·17	−197·4
	1885.						
Jan.	1	+ 5·27	− 83·2	− 9·43	− 97·8	−15·02	−193·4
	2	+10·10	− 60·1	− 4·74	−110·4	−11·77	−188·2
	3	+13·48	− 28·4	+ 0·37	−113·0	8·45	181·6
	4	+14·88	+ 7·3	+ 5·49	−106·4	− 5·08	−173·9
	5	+14·05	+ 42·0	+10·17	− 91·8	− 1·68	165·0
	6	+11·04	+ 69·8	+14·14	− 70·9	+ 1·72	−155·1
	7	+ 6·28	+ 86·5	+17·17	− 45·4	5·10	144·1
	8	+ 0·50	+ 89·0	+19·12	− 17·1	+ 8·45	−132·2
	9	− 5·33	+ 76·6	+19·87	+ 12·3	11·73	119·5
	10	−10·30	+ 51·4	+19·36	+ 40·8	+14·93	−106·0

	Titan.		*Hyperion.*		*Iapetus.*	
0^h Gr. 1885.	α_6-A s	δ_6-D ″	α_7-A s	δ_7-D ″	α_8-A s	δ_8-D ″
Jan. 11	−13·52	+ 17·7	+17·59	+ 66·6	18·02	91·9
12	−14·54	− 18·9	+14·62	+ 87·7	+21·00	− 77·2
13	−13·28	− 52·4	+10·59	+102·3	23·84	62·0
14	− 9·98	− 77·9	+ 5·70	+108·6	+26·52	− 46·6
15	− 5·22	− 91·9	+ 0·33	+105·2	29·03	30·8
16	+ 0·28	− 92·6	− 5·05	+ 91·3	+31·35	− 14·9
17	+ 5·73	− 80·2	− 9·85	+ 67·5	33·48	+ 1·1
18	+10·35	− 56·5	−13·46	+ 35·7	+35·40	+ 17·1
19	+13·48	− 24·8	−15·36	− 0·5	37·10	32·9
20	+14·64	+ 10·4	−15·33	− 36·5	+38·57	+ 48·5
21	+13·60	+ 44·0	−13·44	− 68·0	39·81	63·8
22	+10·46	+ 70·5	−10·00	− 91·8	+40·81	+ 78·7
23	+ 5·65	+ 85·8	− 5·58	−106·1	41·56	93·1
24	− 0·05	+ 86·9	− 0·63	−110·7	+42·07	+106·9
25	− 5·74	+ 73·5	+ 4·37	−106·0	42·33	120·0
26	−10·45	+ 47·9	+ 9·02	− 93·3	+42·34	+132·4
27	−13·42	+ 14·4	+13·04	− 74·1	42·09	144·0
28	−14·21	− 21·4	+16·18	− 50·1	+41·60	+154·8
29	−12·77	− 53·7	+18·29	− 23·0	40·87	164·6
30	− 9·39	− 77·9	+19·26	+ 5·5	+39·90	+173·4
31	− 4·64	− 90·5	+19·03	+ 33·5	38·71	181·1
Feb. 1	+ 0·75	− 90·1	+17·55	+ 59·3	+37·29	+187·8
2	+ 6·03	− 77·0	+14·92	+ 80·9	35·66	193·4
3	+10·44	− 53·0	+11·20	+ 96·7	+33·82	+197·8
4	+13·34	− 21·6	+ 6·63	+104·8	31·79	201·0
5	+14·30	+ 12·8	+ 1·50	+103·7	+29·58	+203·0
6	+13·10	+ 45·2	− 3·75	+ 92·6	27·20	203·8
7	+ 9·89	+ 70·5	− 8·56	+ 71·6	+24·67	+203·4
8	+ 5·11	+ 84·4	−12·36	+ 42·3	22·00	201·8
9	− 0·48	+ 84·4	−14·59	+ 8·2	+19·21	+198·9
10	− 5·97	+ 70·4	−15·01	− 27·3	16·31	194·9
11	−10·45	+ 44·7	−13·57	− 59·2	+13·33	+189·7
12	−13·19	+ 11·7	−10·59	− 84·2	10·28	183·4
13	−13·81	− 23·1	− 6·50	−100·3	+ 7·17	+175·9
14	−12·26	− 54·2	− 1·81	−107·0	4·04	167·4
15	− 8·87	− 77·0	+ 3·02	−104·7	+ 0·89	+157·9
16	− 4·19	− 88·5	+ 7·61	− 94·3	− 2·25	147·5
17	+ 1·08	− 87·4	+11·65	− 77·2	− 5·37	+136·2

	Titan.		*Hyperion.*		*Iapetus.*	
0^h Gr. 1885.	α_8-A s	δ_8-D "	α_7-A s	δ_7-D "	α_8-A s	δ_8-D "
Feb. 18	+ 6·17	− 73·9	+ 14·90	− 55·2	8·43	124·0
19	+ 10·37	− 50·0	+ 17·20	− 29·7	− 11·43	+ 111·1
20	+ 13·09	− 19·2	+ 18·42	− 2·4	14·35	97·5
21	+ 13·89	+ 14·3	+ 18·50	+ 24·9	− 17·16	+ 83·4
22	+ 12·61	+ 45·6	+ 17·40	+ 50·5	19·85	68·8
23	+ 9·39	+ 69·3	+ 15·15	+ 72·7	− 22·40	+ 53·8
24	+ 4·69	+ 82·5	+ 11·85	+ 89·6	24·79	38·5
25	− 0·75	+ 81·8	+ 7·65	+ 99·6	− 27·02	+ 23·0
26	− 6·05	+ 67·5	+ 2·82	+ 101·1	29·05	+ 7·5
27	− 10·29	+ 42·1	− 2·25	+ 93·0	− 30·88	− 8·1
28	− 12·90	+ 9·8	− 7·06	+ 75·3	32·50	23·5
Mar. 1	− 13·39	− 24·0	− 11·03	+ 49·0	− 33·89	− 38·7
2	− 11·79	− 54·0	− 13·64	+ 16·9	35·06	53·6
3	− 8·44	− 75·7	− 14·53	− 17·3	− 35·98	− 68·1
4	− 3·86	− 86·4	− 13·63	− 49·2	36·66	82·1
5	+ 1·25	− 84·7	− 11·16	− 75·4	− 37·08	− 95·4
6	+ 6·17	− 71·1	− 7·50	− 93·4	37·26	108·0
7	+ 10·20	− 47·6	− 3·13	− 102·6	− 37·18	− 119·9
8	+ 12·77	− 17·4	+ 1·50	− 102·8	36·86	130·9
9	+ 13·48	+ 15·1	+ 5·99	− 95·1	− 36·28	− 141·0
10	+ 12·17	+ 45·3	+ 10·05	− 80·6	35·47	150·0
11	+ 8·99	+ 68·4	+ 13·42	− 60·7	− 34·42	− 158·1
12	+ 4·40	+ 80·5	+ 15·93	− 37·1	33·14	165·0
13	− 0·90	+ 79·3	+ 17·44	− 11·2	− 31·65	− 170·8
14	− 6·02	+ 65·0	+ 17·88	+ 15·2	29·96	175·4
15	− 10·14	+ 40·0	+ 17·19	+ 40·6	− 28·07	− 178·9
16	− 12·57	+ 8·5	+ 15·39	+ 63·3	26·01	181·2
17	− 13·00	− 24·2	+ 12·53	+ 81·4	− 23·78	− 182·2
18	− 11·41	− 53·2	+ 8·74	+ 93·4	21·41	182·1
19	− 8·12	− 74·1	+ 4·25	+ 97·7	− 18·92	− 180·8
20	− 3·66	− 84·2	− 0·61	+ 92·9	16·31	178·4
21	+ 1·30	− 82·3	− 5·39	+ 78·7	− 13·60	− 174·8
22	+ 6·07	− 68·9	9·54	+ 55·7	10·82	170·1
23	+ 9·97	− 45·8	− 12·52	+ 26·1	− 7·98	− 164·4
24	+ 12·44	− 16·4	− 13·93	− 6·6	5·11	157·7
25	+ 13·10	+ 15·3	− 13·62	− 38·4	− 2·21	− 150·0
26	+ 11·81	+ 44·6	− 11·71	− 65·7	+ 0·69	141·5
27	+ 8·70	+ 66·9	− 8·54	− 85·8	+ 3·58	− 132·2

	Titan.		*Hyperion.*		*Iapetus.*	
0^h Gr. 1885.	α_6-A	δ_6-D	α_7-A	δ_7-D	α_8-A	δ_8-D
	s	″	s	″	s	″
Mar. 28	+ 4·22	+ 78·5	− 4·55	− 97·5	6·44	122·1
29	− 0·94	+ 77·2	− 0·16	−100·6	+ 9·24	−111·3
30	− 5·91	+ 63·1			11·98	99·9
31	− 9·90	+ 38·6			+14·65	− 88·0
Apr. 1	−12·26	+ 7·9			17·22	75·6
2	−12·71	− 24·0			+19·67	− 62·8
3	−11·11	− 52·2			22·00	49·7
4	− 7·91	− 72·5			+24·20	− 36·4
5	− 3·58	− 82·2			26·26	23·0
6	+ 1·25	− 80·3			+28·16	− 9·5
7	+ 5·89	− 67·2			29·89	+ 4·0
8	+ 9·70	− 44·6			+31·45	+ 17·4

Though, for the sake of uniformity, the places of *Hyperion* are here given to $0^s·01$ and $0''·1$, like those of *Titan* and *Iapetus*, it is to be understood that they may be considerably in error, and that they are merely intended to be sufficiently near the truth to serve the practical requirements of observers. Under present circumstances, and till an approximately correct theory of the disturbed motion of *Hyperion* can be established, a really accurate ephemeris cannot be given. The general effect of the attraction of *Titan* upon the orbit of *Hyperion* may indeed be considered as sufficiently developed; for the evidence of the published observations indicates that the line of apsides of the orbit of *Hyperion* shifts approximately with the line of conjunction of the two satellites, *Hyperion* being, when in conjunction with *Titan*, near the higher apsis of its orbit, or nearly at its greatest distance from *Saturn*. But a knowledge of the observations made during the last three oppositions, together with those of some years to come, is required to allow more detailed inferences to be drawn. The mean conjunctions of the two satellites occur at intervals of 63·637 days in longitudes differing by $-3°·267$, so that the line of conjunction accomplishes a full retrograde revolution in longitude in 19·20 years, or, in reference to the lines of apsides of *Titan*, in 18·71 years, in which period 107 (or sometimes 108) conjunctions take place. The line of apsides of the orbit of *Hyperion* oscillates with regard to the line of conjunction, but for the proper determination of the amplitude of oscillation, the phase of which depends on the position of the apsis of *Titan*, sufficient accurate data are not yet available. To get these data, it is of importance that, in deducing the elements of the orbit for a number of epochs, only observations made during the six or seven weeks midway between two successive conjunctions should be used, since during this time the motion of *Hyperion* is not sensibly affected by *Titan*, and the

elements may be treated as constant. It is only during the two or three weeks including the conjunction, that the alteration of the orbit of *Hyperion*, and especially the retrograde shifting of the apsis, is effected, and the observations made during this state of transition of the elements ought not (for the present) to be mixed up with those preceding or following, nor these with one another. It is, however, very desirable that the observations near the times of conjunctions should be specially attended to; and it will perhaps be most advantageous to observe the places of *Hyperion* at these times, not in reference to the centre of *Saturn*, but to *Titan* itself. During the period over which the present ephemeris extends the conjunctions of the two satellites occur 1884 Oct. 17, Dec. 20, and 1885 Feb. 21, this last being the 210th conjunction since the discovery of *Hyperion*.

Though the predicted places of *Titan* and *Iapetus* may not be much in error, it would be far more satisfactory if they could be founded upon better than makeshift elements. Observers must be good enough to publish all important series of observations of the satellites, if it is desired that the ephemerides should be up to the mark.

Sextant Observations of Comet Pons-Brooks, made on board the ship "British Envoy." By Capt. John P. Holdich, R.N.R.

(*Communicated by Capt. H. Toynbee.*)

Date.	A.T.S. P.M. h	Lat. S. ° ′	Long. E. ° ′	α Tauri. ° ′	α Argus. ° ′	α Orionis. ′	α Ceti. ° ′
Jan. 23	9·0	41 40	12 55	74 40	80 14		
26	8·55	44 9	23 50	73 16	85 27		47 0
31	8·55	41 50	44 45	72 28	67 46		
Feb. 3	9·5	42 30	57 45	72 5	64 14		
16	9·10	42 0	98 0		51 34	79 30	
20	9·5	41 20	114 0	73 10	49 12		
	9·0	41 5	118 40	73 20	48 50	78 40	
25	9·10	39 56	133 20	74 18	46 10		

Remarks.

Jan. 26 Better observations than before, comet brighter. Tail about 4° towards α *Ceti*.

Feb. 3 to 16 Moonlight too strong.

16 Tail hardly visible, and nucleus only when Moon is clouded.

20 Fair observations of nucleus. Tail barely visible, except with glasses.

25 Comet getting very indistinct to naked eye, and through glasses getting more the appearance of a nebulous cloud with bright centre.

Sextant observations corrected for index error.
Chronometer time was not taken.
Ship's position by D.R. from noon observations.

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